Acquisition Directorate
Research & Development Center

Report No: CG-D-09-11

Final Great Lakes Exercise 1 Report

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July 2011

Homeland Security

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Technical Report Documentation Page

1. Report No.	2. Government Accession Number	3. Recipient's Catalog No.
CG-D-09-11		

4. Title and Subtitle	5. Report Date / 6. Performing Organization Code
Final Great Lakes Exercise 1 Report	5. Report Date: July 2011 6. Performing Organization Code: Project No. 4701
7. Author(s) David Cooper, Daniel Dugery	8. Performing Organization Report No. RDC UDI No. 1126
9. Performing Organization Name and Address U.S. Coast Guard Research and Development Center 1 Chelsea Street New London, CT 06320 SAIC 23 Clara Drive, Suite 206 Mystic, CT 06355-1959	10. Work Unit No. (TRAIS) 11. Contract or Grant No. Contract HSCG32-10-D-R00021/ Task Order HSCG32-11-J-300015 Deliverable No. 3
12. Sponsoring Organization Name and Address U.S. Department of Homeland Security Commandant (CG-533) United States Coast Guard 2100 Second St. SW Washington, DC 20593-0001	13. Type of Report & Period Covered Final 14. Sponsoring Agency Code Commandant (CG-533) U.S. Coast Guard Headquarters Washington, DC 20593-0001

15. Supplementary Notes

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16. Abstract (MAXIMUM 200 WORDS)

This report describes a three-day exercise involving oil spill response equipment for use in broken ice conditions. The exercise was conducted in the Coast Guard Sector Sault Ste. Marie operating area. During the exercise, a select group of Oil Spill Response Organizations (OSROs) demonstrated logistics and equipment.
A newly designed grooved drum skimmer was fitted with a steam/hot water hook-up. This concept should help reduce the viscosity of oil being collected, and minimize ice blockages. A fire boom was mobilized and towed in a U-configuration using two small vessels. The boom held the configuration but the small vessels seemed underpowered for the task.

A fire monitor was also used to "herd" oil into a containment boom, demonstrating multiple logistical implications.

An older design rope-mop skimmer was also demonstrated. This unit showed some operational quirks but would be useful under certain circumstances due to its size and power requirements.

A Boom Vane was also demonstrated, along with an additional small drum skimmer. The boom vane, controlled from shore, utilized water current to hold a diversion boom in place while the small skimmer operated in the pocket of the boom.

Recommendations are provided for further study in colder conditions using oil simulants.

17. Key Words	18. Distribution Statement
oil spill, containment, skimmer, field demonstration, oil in ice, cold weather, OSRO	Distribution Statement A: Approved for public release; distribution is unlimited.

19. Security Class (This Report)	20. Security Class (This Page)	21. No of Pages	22. Price
UNCLAS//Public	UNCLAS//Public	38	

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ACKNOWLEDGEMENTS

We would like to thank the following for their support in this exercise.

- USCG Sector Sault Ste. Marie
- USCG District D9
- CAPT John Wellington, Carbide Dockmaster

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EXECUTIVE SUMMARY

The U.S. Coast Guard (USCG), the Canadian Coast Guard, the Environmental Protection Agency (EPA), Environment Canada and other state and provincial agencies routinely respond to oil spills during the winter months in the Great Lakes areas. Increasing vessel and barge traffic increases the potential for additional accidental discharges. While oil recovery issues have come to the attention of responders, researchers, and other stakeholders, work continues on improving response capabilities under possibly harsh conditions.

Cold climate conditions including the presence of ice would complicate a response effort. Studies investigating the behavior of oil, current capabilities, and data gaps over the past two decades have helped increase our understanding of processes that take place during a spill. In spite of this, there is a need for more work to improve response capabilities.

This effort is the first in a series of planned on-water exercises to assess current spill response capabilities and will attempt to identify operational performance gaps. The design of this project is to leverage the needs and requirements of both Arctic and Great Lakes environments in order to identify equipment and techniques that would work in both locations to recover spilled oil.

This project centers on a 3-day field exercise during which a select group of Oil Spill Response Organizations (OSROs) had the opportunity to demonstrate selected equipment with potential for use in ice-infested waters. As part of the goal of collecting information on equipment staging and operation, requirements for offloading, setup and deployment as well as operations were noted.

The first piece of equipment evaluated was a grooved drum skimmer with a steam/hot water hook-up. Assembly of the components and deployment of the skimmer was accomplished by three personnel in about an hour, although perhaps 20 minutes of this time was spent explaining the procedures to the other exercise participants. Once the skimmer was deployed, the steam/hot water system was engaged to simulate response actions if a spill occurred in broken ice conditions. Steam was seen rising off of the steam/hot water piping which would transfer heat quite readily to any oil collected during recovery operations.

The next piece of equipment deployed was the PyroBoom®. A small workboat with sections of the boom attached towed the equipment in a containment (U-shaped) configuration. This process initially worked as the vessels travelled at low speed but the workboats seemed underpowered and less stable as speeds were increased.

A self-contained fire monitor was demonstrated as a means of guiding or directing oil into a boomed area by working in conjunction with the slow-moving current to force the oil in a specific direction. This concept appeared to function well as the water jet from the fire monitor had a wide range of impact. The main detriment to this device was the fact it weighed well in excess of 3000 lb which limits its working platform to larger vessels.

A rope-mop skimmer that was approximately 30 years old was brought to the exercise to demonstrate the technology and key aspects of the design of the rope-mop. A relatively minor snag occurred but was rectified within 5 minutes as the rope-mop seemed to jam slightly then fell off the guiding pulley. The pulley was simply readjusted and the demonstration continued.

The next piece of equipment used at the demonstration was the Boom Vane. This unit was deployed from the shoreline, pulling a containment boom in a specific configuration while a small drum skimmer was deployed within the containment area. The Boom Vane had to be adjusted as the containment boom was anchored close to the entrance to a ferry dock. As the ferry would enter and leave the area, the Boom Vane was triggered to move closer to shore to avoid any interference with the operation of the vessel. This provided ample opportunity to determine the sensitivity of the control of the Boom Vane.

Multiple pieces of equipment that had potential for use during a spill clean-up in ice-infested waters were successfully staged and deployed. Minor issues which could impact spill recovery work were identified and recommendations were made to continue with the next phase of demonstration, ideally under colder conditions along with the use of an oil simulant.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF ACRONYMS

D9	District 9
EPA	Environmental Protection Agency
MOP	Measure of performance
OSRO	Oil Spill Response Organization
PPE	Personal Protection Equipment
RDC	Research & Development Center
SAIC	Science Applications International Corporation
U.S.	United States
USCG	United States Coast Guard

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1 BACKGROUND

In the northern climates of the United States, especially in the Great Lakes, the U. S. Coast Guard (USCG), Canadian Coast Guard, Environmental Protection Agency (EPA), Environment Canada and other state and provincial agencies routinely respond to oil spills during the winter months. Currently, the majority of the spills are tank leaks and fuel truck accidents that occasionally occur near waterways, allowing the spilled oil to reach navigable waters like harbors and rivers. While the oil recovery issues have been generally identified, reduced ice during the winter season may lead to increases in vessel and barge traffic, increasing demands for improvements in support infrastructure (Reference 1). The increased vessel traffic, along with an aging pipeline infrastructure, increases the potential for accidental discharges.

Harsh weather in cold climate conditions including the presence of ice would complicate response efforts (References 2 and 3). Many organizations have begun to realize the impacts of these complications and have begun to review all issues surrounding spills in cold climate conditions, including areas such as the following.

- identifying the behavior of oil (References 4 and 5)
- identifying the current capabilities and data gaps using conventional equipment (References 6)
- identifying advances or techniques such as oil-mineral aggregate promotion (References 7)
- modification of skimmers (Reference 8) that may be used to minimize the damage and accelerate the remediation of spilled oil have been, or are currently being reviewed (References 9 through 14)

To address these concerns, and to take advantage of emerging oil recovery technologies, northern climate regions are re-evaluating spill remediation equipment and techniques that are available (Hansen and Lewandowski 2011 (References 15 and 16). Parallel efforts in District 17 are underway to increase the spill response capabilities off the North Slope of Alaska in anticipation of increased exploration, drilling, and shipping.

1.1 Introduction and Objectives

This effort is the first in a series of on-water exercises that will assess current spill response capabilities and will attempt to identify operational performance gaps. Each successive exercise will build on the previous one as well as take advantage of new response developments. This project is designed to leverage the needs and requirements for both Arctic and Great Lakes environments in order to identify equipment and techniques that would work in both locations.

This project was comprised of a three-day field exercise that included a half-day introductory discussion on responding to oil in or under ice, one day of shoreline deployments in still water (Test Day 1), and one day of vessel deployments in slowly moving water (Test Day 2). During the exercise, a select group of Oil Spill Response Organizations (OSROs) demonstrated the capability of various types of spill response equipment. This equipment was selected based on what would be immediately available if a spill occurred. This included equipment that was already in the responders' inventory, that which could be easily accessed or could be deployed as a basic response was implemented. Following each test period, a "hot wash" session was held to assess performance and collect lessons learned.

1.2 Participating Organizations

The groups (Individuals listed in Appendix B) participating in the exercises were:

- USCG Research & Development Center (RDC): Provided Test Director to oversee all Coast Guard test evolutions.
- USCG Sector Sault Ste. Marie: Provided personnel and logistical support. (See Appendix A for local area maps.)
- USCG District 9 (D9): Provided personnel and logistical support.
- USCG Oil Response Unit: Provided personnel and logistical support.
- Michigan Department of Environmental Quality: Observer.
- Government of Ontario, Canada: Observer.
- Science Applications International Corporation (SAIC): Provided Test Coordinator, personnel, and logistical support.
- OSROs: Provided equipment, personnel, and logistical support.

1.3 Exercise Concept

This exercise focused on the logistics and equipment involved in conducting simulated oil recovery from ice-infested waters. This scenario is focused on broken ice conditions that would not allow personnel and equipment to be placed on the ice to carry out the more traditional responses familiar to the Great Lakes region. Although tentatively considered in the early stages of planning, the use of oil surrogates to demonstrate a spill was cancelled due to stakeholders' environmental concerns. Local OSROs demonstrated their ability to mobilize equipment and simulate the recovery of oil in adverse cold-weather conditions from shore and in slow-moving water.

1.4 Exercise Schedule

Table 1 contains the high-level schedule for the field tests.

Table 1. Schedule of events.

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
17 April 2011	18 April 2011	19 April 2011	20 April 2011	21 April 2011	22 April 2011	23 April 2011
	Travel	Brief/Setup	Test Day 1	Test Day 2	Travel	

2 EXERCISE OBSERVATIONS

2.1 Monday, 18 April 2011

The team conducted an initial pre-test briefing to discuss logistics and any issues that might impact the planned schedule. The weather forecast predicted heavy snow for Wednesday which could have impacted mobilization of equipment efforts for the demonstration. Weather forecasts were closely monitored to determine if changes to the schedule should be made on Tuesday to allow more buffer time between tests on Wednesday.

2.2 Tuesday, 19 April 2011

An initial kick-off meeting and safety briefing at USCG Sector Sault Ste. Marie ran from 8:00 am through 10:00 am. It included a presentation by Mr. Kurt Hansen, USCG RDC Exercise Test Director, that reviewed oil-in-ice research conducted and response capabilities developed since the late 1960s and early 1970s. The presentation identified reasons for the demonstration and why certain equipment would tentatively be used during a response. A few issues of concern previously identified in workshops in Anchorage, AK and Cleveland, OH highlighted differences between Arctic and Great Lakes conditions (ice behavior, fresh water versus saline, etc.) which may impact recovery efforts. The pending adverse weather and the planned schedule was reviewed to update the participants on an accelerated timeline for equipment demonstrations on Tuesday due to the prospect of up to 8" of snow on Wednesday. Other presentations were done by Mr. Bill Hazel of Marine Pollution Control and Mr. Stewart Ellis of Elastec/American Marine.

The equipment discussed in the following sections was demonstrated on Tuesday against applicable measures of performance (MOPs) from (Table 2).

Table 2. Measures of performance.

MOP	Remarks
Developmental stage	Prototype or production
Size	Weight and cube
Transportability	Self-contained, air- or truck-transportable
Difficulty in handling	Number of personnel, forklift requirement
Overall quality	Ruggedness, environmental suitability, simplicity
Viability of procedures	
Launch	Number of personnel, heavy lift requirement, time required
Positioning	Vessel movement, boom manipulation
Retrieval	Number of personnel, heavy lift requirement, time required
Pack-up and storage	Time and number of personnel required
Operational observations	
Overall system performance	Start-up time/complexity, maintenance requirements/down time, reliability, safety
Adjusting settings	Ease and accuracy of on-the-fly changes
Ease of operation	Number of personnel and training required for steady-state operation
Reliability	Structural integrity and consistency of performance
Safety	Exposure to noise, hot components, high pressure, electrical

2.2.1 Heated Skimmer (Elastec TDS136 Skimmer, E150 Pump, D10 Powerpak)

The heated grooved drum skimmer is a production model approximately 0.9 m long x 2.3 m wide x 0.5 m high and has a weight of approximately 68 kg. The skimmer demonstrated has a strong potential for use in an oil spill in broken ice or where the ice has been fragmented. The setup of the equipment was straightforward, consisting of a trailered power unit/water heater/supply tank (Figure 1), a separate prime mover/control stand (Figure 2), the skimmer head (Figure 3), and a collection of hydraulic hoses, hot water supply lines, and discharge hoses. The demonstration was conducted off the USCG Sector Sault Ste. Marie pier. Deployment and recovery of the skimmer were performed by a mobile crane supplied by the Coast Guard although the skimmer head was light enough to be hand-deployed.

Assembly of the equipment was straightforward with the heating unit water tank requiring a fresh water supply of water to heat and send to the skimmer. Three personnel set up the equipment in approximately 65 minutes. Part of this time was spent explaining the procedures to the participants of the exercise; the actual set-up time would probably be 20 minutes less.

Figure 1. Power unit/water heater.

Figure 2. Control stand.

Figure 3. Grooved skimmer head.

Though no ice was present, the skimmer physically operated as per the vendor's description (Figure 4). Observation showed that the heating elements placed inside the frame were heating the unit (producing steam) which would allow oil to flow in the collection area of the skimmer.

Figure 4. Heated skimmer operating.

A discharge tube at the front of the skimmer allowed hot water and steam to spray onto the water's surface which would ideally keep the area ice-free, allowing oil to flow on the water's surface and onto the rotating drum. Further testing in ice conditions will show the extent of the surface ice melting and/or oil/ice washing provided by this hot water/steam discharge. The heater and hydraulic units both need to be periodically refueled and the equipment needs to be monitored during operation. The discharge hose length attached to the ES400 Helical Screw Pump would be dependent upon the viscosity of the liquid being recovered, with shorter hose discharge lengths being required as viscosity increased.

Overall, this unit is expected to be effective in skimming oil in partial ice covered conditions.

2.2.2 PyroBoom® (Applied Fabric Technologies, Inc.)

PyroBoom is a fire-resistant floating barrier for control of oil during in-situ burning operations, and was one of the booms used during the Deepwater Horizon Response. It has a nominal draft of 19 inches (48 cm), a freeboard of 11 inches (28 cm), an overall height of 30 inches (76 cm), and weighs approximately 9 lbs/ft (13.4 kg/m) (Figure 5). Sections of the PyroBoom were removed from a shipping crate with assistance from a mobile crane (Figure 6) supplied by the Coast Guard. According to the manufacturer, the refractory barrier is comprised of inconel interwoven with stainless steel and fiberfrax refractory fibers, and then coated with silicone. Due to the weight of the boom (approximately 500 lb per 50' section), the manufacturer suggests that a minimum of four people be available to handle the boom. The manufacturer also recommends wearing heavy leather gloves to aid in handling and protect against sharp edges or wires. Sections were coupled together and a ramp was assembled to ease deployment from the pier. The time required to remove the boom from the crate, connect sections, and deploy into the water was approximately 30 minutes. After deployment, the boom was towed in a series of configurations typically used with a containment boom. One interesting feature pointed out by the manufacturer is the ability to recondition the boom in the field following its use in oil burns.

Operational commitments precluded the use of Coast Guard vessels and two stand-in vessels were secured. During towing operations, the two boats were able to maneuver the boom, albeit with some difficulty owing to the mismatched size and horsepower of the boats. The rather flat underwater profile of the work boats may have also attributed to some of the difficulty in maintaining U-configurations while sweeping through the water. It was felt that the 90 hp motor of the smaller vessel was undersized to maneuver the 100' of boom that was deployed. Larger boats with similar horsepower would be better suited for the towing task.

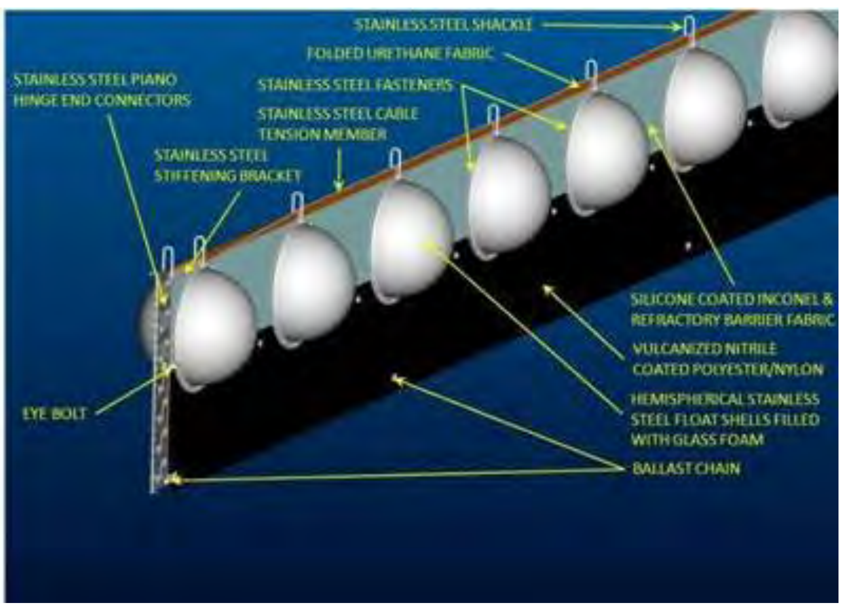

Figure 5. PyroBoom component diagram.

Figure 6. PyroBoom being prepared for deployment.

The boom was successfully deployed, maneuvered, and retrieved during this exercise (Figure 7). The PyroBoom would be a useful tool in combating an oil-in-ice incident as long as sufficient room was reserved for the boom to be deployed and maneuvered in such a way as to allow it to capture oil for burning, and that appropriately sized vessels were employed to facilitate movement within the water.

Figure 7. PyroBoom being towed in containment configuration.

Following the retrieval of the boom, a meeting was held on the pier to discuss the events of the day and recap lessons-learned, identify any issues that transpired, and plan for Wednesday.

2.3 Wednesday, 20 April 2011

A safety briefing and daily kick-off meeting was conducted at USCG Sector Sault Ste. Marie from 8:00 am to 8:30 am. Mr. Mike Popa of T&T Bisso gave a presentation that described previous experiences when responding to oil in ice in the Great Lakes, specifically for a sunken tugboat in December, 2010.

The equipment discussed in the following sections was demonstrated on Wednesday.

2.3.1 Herding with Fire Monitor (Hale)

A demonstration of herding free oil on the water surface was conducted at the Union Carbide Docks. The fire monitor consisted of a self-contained Hale firefighting pump and John Deere diesel power pack with an 8-hour operation fuel tank (Figure 8). The fire monitor is capable of pumping up to 1500 gpm water and is foam capable. The fire monitor package, weighing 3450 lb, was placed on a tug using a barge-mounted crane. Afterwards, a standard anchored deflection boom was set up to designate the area they planned to herd the oil towards and the tug then got underway. Once in position, the fire monitor was powered up and the stream of water, 20-50 feet long, was sprayed onto the water's surface resulting in visible water currents being directed towards the boom (Figure 9).

This technique has been used previously in open (ice-free) water environments to aid in collecting oil. In an ice-covered or partially ice-covered waterway situation, this method should be quite successful in moving the surface oil towards containment or skimmers from a floating or fixed location. An additional use is to aid in the movement of broken ice on the water surface, keeping the ice from interfering in oil recovery operations.

Figure 8. Fire monitor.

Figure 9. Fire monitor in use.

One drawback to the fire monitor pack is its 3450 lb weight, which limits it to larger vessels and requires a crane to maneuver the package. Fire monitors and hoses already installed on vessels could be used in place of this fire monitor pack and should generate similar results. Any vessel using such a system would require adequate displacement to counter the thrust imposed by the water stream.

2.3.2 Rope-Mop Skimmer (Oil Mop, Inc.)

The rope-mop skimming device (Figure 10) demonstrated from the Coast Guard pier was an Oil Mop, Inc. model OM-01 with a pull-start Lombardini diesel motor and 50' x 4" oil absorbent rope element.

Figure 10. Rope-mop skimmer head.

This unit, weighing 378 pounds, was set up and deployed by contractor personnel within 30 minutes. It relies on a restriction between two metal rollers to extract oil from the absorbent rope, which collects in the pan below the unit. The pan has connection ports so that it can be pumped out as needed (Figure 11).

Figure 11. Extraction mechanism.

As the skimmer operated (Figure 12), some issues were noted including the susceptibility of the rope-mop to occasionally slip off the guiding pulley (Figure 13) holding the rope-mop away from the skimmer head.

Figure 12. Rope-mop skimmer operating.

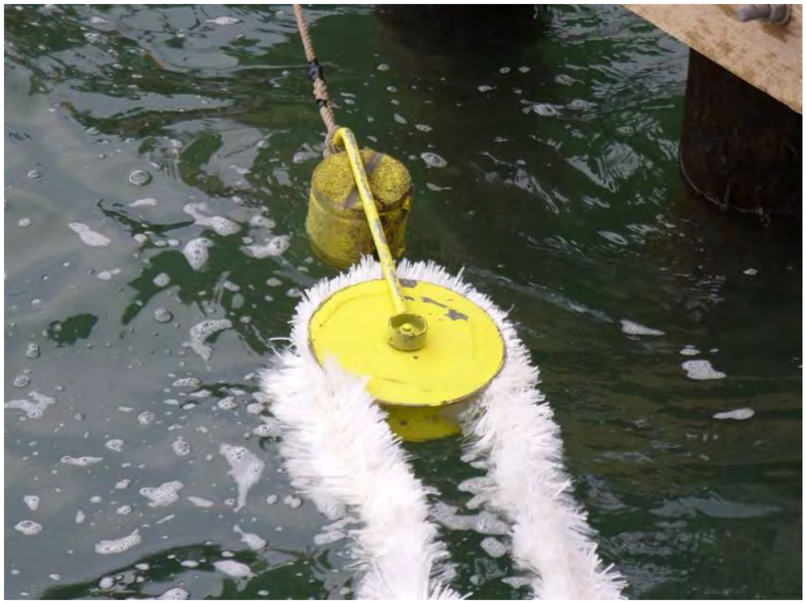

Figure 13. Guiding pulley.

The skimmer then had to be shut down while adjustments were made. The skimmer required constant monitoring, adjustment, and maintenance to keep it operating properly. These problems may not arise if the rope is kept more horizontal. This unit represented approximately 30-year old technology; however, the concept has historically proven successful in collecting oil along slots cut in solid ice when oil has migrated under ice sheets. Four workers were able to lift and maneuver the skimmer/motor assembly using the integrated lifting points. The motor employs a manual pull-starter which simplifies the equipment (ideal for remote locations where equipment breakdowns can cause issues due to extended repair times); however, starting the motor in cold conditions could prove challenging. Some concern was noted about how messy the collection could be given the design of the rope-squeezing mechanism and the integrated collection tray under the motor.

2.3.3 Boom Vane (ORC AB)

The demonstration of the Boom Vane (Figure 14 and Figure 15) was conducted off the Rotary Park piers using 150’ of containment boom attached to the shore at one end with the Boom Vane on the upstream side. The wing unit of the Boom Vane is approximately 1.8 m x 0.3 m x 1.0 m and weighs 46 kg, while the float unit is approximately 1.4 m x 0.2 m x 0.8 m and weighs 16 kg. Several contractor personnel did the assembly and deployment of the Boom Vane quickly from the pier area (Figure 16). According to the manufacturer, no tools are required for assembly, deployment, or dismantling of the Boom Vane. Once in the water, the Boom Vane was “tripped” and the vane end of the boom quickly and forcefully pulled the free end of the boom into the channel, allowing it to divert oil from a fast water area to a calmer area minimizing possible entrainment of the oil and allowing skimming of the oil. The Boom Vane was then used to move the end of the boom in and out of the current to demonstrate its versatility (Figure 17).

Figure 14. Boom Vane.

Figure 15. Boom Vane wing.

Figure 16. Deploying the Boom Vane.

Figure 17. Boom Vane controlling boom.

A small drum skimmer (Figure 18) was deployed in the apex of the boom to show how a skimmer would be used in conjunction with the boom and Boom Vane. The skimmer was a Crucial/Model; C-1D18H-36 with a 36" Drum Skimmer and weighs about 150 pounds.

The drum skimmer had a fuzzy material attached to the drum (Figure 19). It was noted that this material actually helped the skimmer pick up a substantial quantity of water. During actual spill recovery efforts, it has been shown that this type of skimmer with a “fuzzy” material-coated drum, once in contact with oil, will become hydrophobic and the quantity of water being collected with the oil will decrease.

Figure 18. Deploying drum skimmer.

Figure 19. "Fuzzy" drum skimmer.

Though demonstrated here in ice-free waterways, this Boom Vane has a great deal of potential in oil cleanup in ice conditions. The boom could be deployed using the vane to divert oil to a clean-up area; then when broken ice threatens the boom, it could be moved out of the path of the ice. The vane can also be used in areas where a vessel is not available for fast boom deployment. It should be noted that the Boom Vane requires currents greater than 1 knot to operate and a loss of precise steering control will result from slower currents. It can be used in current or towing conditions up to at least 6 knots.

2.4 Thursday, 21 April 2011

Equipment was crated and collected or temporarily stored in preparation for shipment back to the respective manufacturers/operators.

3 CONCLUSION(S)

Some problems were identified during the deployment of equipment. First, failures of a hose connection seal and jamming of a second hose connector on separate pieces of equipment caused some minor delays. In addition, the operating controls and functions of most of the equipment were not suited for extremely cold weather. Most of the systems will need adaptation for operators to use with heavy gloves and operations involving viscous oils. The speedy resolution to the operating issues was helped, in no small part, by the operator's familiarity with the equipment and the availability of appropriate spare parts. This is an example of why operator training on the equipment is so important and highlights the fact that small parts failing on equipment may force delays or even complete shutdowns during recovery operations. Another one of the larger issues identified in the demonstration was the need to keep personnel warm, dry, fed, and rested. During the second day of demonstrations, a series of snow squalls moved through the area which significantly reduced visibility and made the ground somewhat slick. In spite of the additional challenges, personnel operating the equipment were able to adapt to the changing environmental conditions and safely deploy and recover the boom and Boom Vane. This highlights how operating in cold weather quickly complicates spill response efforts not only from an equipment perspective, but from a personnel perspective as well.

Cool (below freezing) temperatures occurred during the exercise but no actual ice was available in the immediate area for testing which limited the evaluation of the equipment to simple deployment, retrieval, and limited operational characteristics. Though no ice was present during the equipment demonstrations, this project brought Coast Guard and contractor personnel together to look at how best to select, deploy, and effectively use oil response equipment in a cold and potentially ice-infested environment. The following specific conclusions were developed following a review of the operation of each piece of equipment demonstrated during the exercise.

- The grooved drum skimmer heated up the surrounding water, ejecting steam at the discharge nozzle and within the trough of the skimmer. This should help it process thicker oil and possibly melt smaller ice pieces so they will not clog any pumps or hoses.
- The grooved drum skimmer was light and maneuverable, requiring three to four personnel to assemble and manually stage before the exercise began. The unit was launched using a truck mounted crane; perhaps a bit overkill in this scenario, but retrieval back onto the dock would have been difficult without the use of the crane.
- The PyroBoom required some planning in order to properly deploy, primarily due to the size and weight of the equipment. Once in the water and towed into position, the boom was maintained in U-shaped configurations in the channel just off from the dock. Unfortunately, no oil or simulants were used which would have helped determine containment capabilities. One would expect performance to be similar to other containment booms when towed at slow speeds (up to 0.75 knots). Vessels selected should be powerful enough to control the boom under difficult wind, wave and environmental (e.g. icing) conditions and also provide protection to crewmembers. These vessels would be mostly likely over 50 feet in length, require a minimum of 250 hp, and be ice-strengthened.
- The Hale Fire Monitor was successfully deployed onto the tug and was operated effectively for approximately 45 minutes near the Carbide dock. This system could be used to direct or divert oil in the event of a spill. Due to the lack of actual oil or simulants, it is difficult to draw any definite conclusions based upon the performance witnessed.
- The Hale Fire Monitor weighed in excess of 3,000 pounds, requiring a lifting capability as well as a platform of sufficient size to accommodate the pump/monitor.

- The rope-mop skimmer is a compact all-in-one package and can be operated from shore. Some oil contamination might be expected to collect at the front of the unit over a period of time. This is due, in part, to the design of the system, the way oil is extracted from the rope, and the path the rope takes to get to the extraction point.
- The rope-mop skimmer was operated over a period of approximately 30 minutes but did have some initial issues with the rope-mop snagging on the remote pulley guide. The operators, however, were able to get the rope-mop fixed in less than 2 minutes.
- The Boom Vane was deployed into fast moving water. The system operated as designed but this technology may suffer limitations if ice coverage increases past a minimal point. Collisions with smaller pieces of ice in fast-moving waters may not be an immediate issue but over time they may be trapped by the containment system. The accumulation of ice within the boomed area would impart additional stresses on the system and may accelerate a failure mode. Additional operator care would have to be taken in broken ice conditions as impacts by chunks of ice may damage, block, or interfere with the vanes or with the wing, affecting control of the device.
- The “fuzzy” skimmer seemed to retrieve a large quantity of water when operated within the boomed area. This would decrease once the drum came in contact with oil and became oleophilic. Water collection is expected to quickly diminish once oil contact is made. Small units such as this skimmer may offer good maneuverability between chunks of ice and open water to get to the oil. If sufficiently cold, however, ice may build up on the “fuzzy” drum surface and impede the collection of oil.

One general operational conclusion was also noted during this exercise.

- Weather became a factor during the testing, and would affect response personnel in the event of a spill. Cold weather will slow down operations and require additional personal protection equipment (PPE).

4 RECOMMENDATIONS

Further demonstrations and exercises should be planned during the ice season with oil surrogates to better demonstrate and evaluate the equipment and techniques shown during this project. In addition, future exercises should emphasize vessel deployments; and focus on broken ice conditions and operating in open water adjacent to ice, including any newly developed equipment. Future exercises will also continue to emphasize the use of the local OSROs; so that experience can be gained in this area. Specific recommendations include the following.

- Research the use of oil or surrogates such as rice hulls, oranges, or other environmentally benign materials to help evaluate containment and collection abilities of the equipment being deployed.
- Perform exercises earlier in the season to increase the probability of having readily available ice.
- Perform exercises in varying ice coverage and ice thicknesses to determine operational limitations of the equipment.
- Secure vessels for the exercises and establish alternate resources if possible. It is understood that operational obligations may affect an exercise, getting additional buy-in may help secure additional resources as back-up.
- Source possible vessels of opportunity as alternate working platforms in order to train crews to become familiar with working off these platforms; and to establish procedures to get equipment onto and off of these platforms. Training in this mode will help develop skills and establish good working relationships among personnel.

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APPENDIX A LOCAL AREA MAPS

The demonstrations were conducted at Sault St. Marie. Figure A-1 depicts the geography of the general operating areas of Sault Ste. Marie and greater St. Mary's river area. Figure A-2 and Figure A-3 show the main exercise locations.

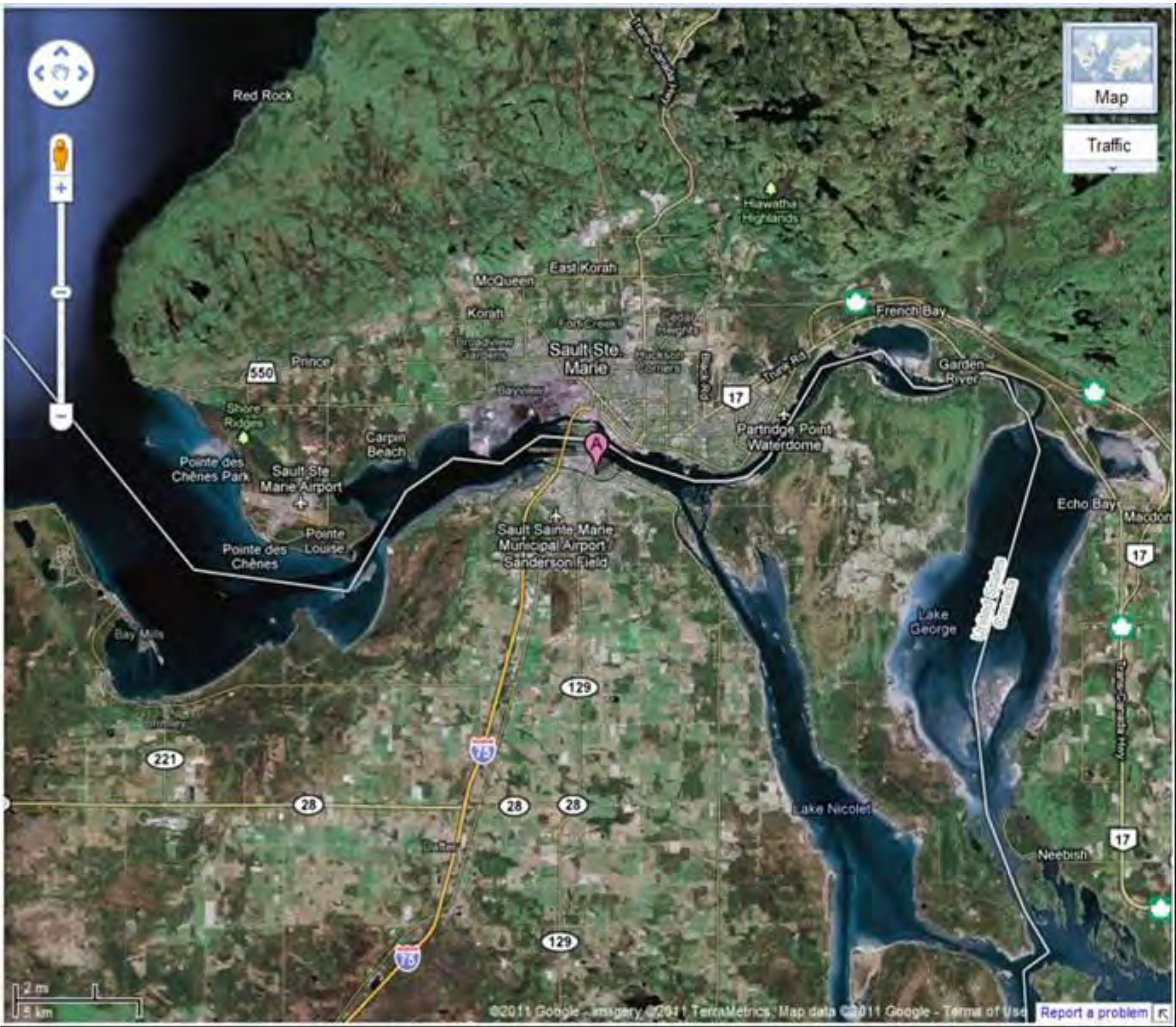

Figure A-1. Sault Ste. Marie and greater St. Mary's river area.

Figure A-2. USCG Sector Sault Ste. Marie pier.

Figure A-3. Carbide dock.

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APPENDIX B EXERCISE PLANNING AND PARTICIPANTS

Table B-1. Exercise planning and participants.

Name	Agency	Email Address	Participated Sault Ste Marie Tests
State/Local Representatives			
Roger Lauder, MGR	Illinois	roger.lauder@illinois.gov	
Christopher Conn	Michigan Department of Environmental Quality Water Resources	connc@michigan.gov	X
David Walters	Michigan Department of Environmental Quality Water Resources	waltersd@michigan.gov	X
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David Woodbury	Wisconsin	david.woodbury@wisconsin.gov	
Roxanne Chronert	Wisconsin	roxanne.chronert@dnr.state.wi.us	
Max Michael	Indiana	mmichael@idem.in.gov	
John Wellington	Harbor Master Carbide Dock	wellington@lighthouse.net	X
Ryan D. Blazic	USCG MSU Toledo, OH	blazicr@michigan.gov	
Jim Mehl	Division of Emergency & Remedial Response Ohio Environmental Protection Agency	jim.mehl@epa.state.oh.us	
Kurt Kollar	Division of Emergency & Remedial Response Ohio Environmental Protection Agency	kurt.kollar@epa.state.oh.us	X

Table B-1. Exercise planning and participants (Continued).

Name	Agency	Email Address	Participated Sault Ste Marie Tests
US Government Representatives			
Kurt Hansen	RDC	kurt.a.hansen@uscg.mil	X
Alex Balsley	RDC	alexander.balsley@uscg.mil	X
John McLeod	RDC	john.a.mcleod@uscg.mil	X
MK2 Andrew Johnson	Atlantic Strike Team	andrew.r.johnson@uscg.mil	X
Joel Ferguson, LT	Atlantic Strike Team	joel.s.ferguson@uscg.mil	
Kevin Sligh, LCDR	Atlantic Strike Team	kevin.m.sligh@uscg.mil	
MKC Frank Hohmann	Pacific Strike Team	franklin.d.hohmann@uscg.mil	X
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MK2 Benjamin Repa	Sector SSM, Facilities, Crane operator (SSM)	benjamin.r.repa@uscg.mil	
PO2 (SSM)	Sector SSM		X
PO2 (SSM)	Sector SSM		X
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Mary Hoffman, LT	D9 Cleveland	mary.d.hoffman@uscg.mil	
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John Lomnicky	NOAA	john.lomnicky@noaa.gov	X
Direct Government Contractors			
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Dan Dugery	SAIC	daniel.j.dugery@saic.com	X
Thomas McClay	SAIC	thomas.e.mcclay@saic.com	

Table B-1. Exercise planning and participants (Continued).

Name	Agency	Email Address	Participated Sault Ste Marie Tests
Equipment Contractors			
Stewart Ellis	From Elastec American Marine	stewart@elastec.com	X
Peter Lane	Applied Fabric	lane@afti.com	X
Adam Schreckengost	Applied Fabrics		X
Kenneth Hartmann	Applied Fabrics		X
Bill Hazel	MPC	billh@marinepollutioncontrol.com	X
Mike Popa	T&T Bisso	mp@ttbisso.com, mikepopa@tandtbisso.com	X
Kevin Hall	Contractors that worked setting up the equipment for T&T Bisso and MPC		X
Kiernan Rancilio	Contractors that worked setting up the equipment for T&T Bisso and MPC		X
Joe Calcaterra	Contractors that worked setting up the equipment for T&T Bisso and MPC		X
Brad Jeffers	Contractors that worked setting up the equipment for T&T Bisso and MPC		X
Ed Radeke	Contractors that worked setting up the equipment for T&T Bisso and MPC		X
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Ryan Wheeler	Environment Canada	ryan.wheeler@ec.gc.ca	

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